

CLAIMS

1. A small zoom lens comprising:

5 a first lens group that comprises a lens having a negative refractive power, a lens having a positive refractive power and a lens having a positive refractive power, arranged in that order from an object side, that has a positive refractive power as a whole, and that is fixed with respect to an image plane;

10 a second lens group that has a negative refractive power as a whole, and that causes a zooming action when moved along an optical axis;

an aperture stop that is fixed with respect to the image plane;

15 a third lens group that comprises a lens having a positive refractive power and a lens having a negative refractive power, that has a positive or negative refractive power as a whole, and that is fixed with respect to a direction of the optical axis when zooming and when focusing; and

20 a fourth lens group that has a positive refractive power as a whole, and that moves along the optical axis such that the image plane, which is displaced by a movement of the second lens group along the optical axis and by a movement of the object, is maintained at a constant position with respect to a reference plane.

2. The small zoom lens according to claim 1,

25 wherein the second lens group comprises at least one aspherical surface, and comprises a meniscus negative lens whose convex surface faces the object side, a lens having a negative refractive power and a lens having a positive refractive power, arranged in that order from the object side.

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3. The small zoom lens according to claim 1,
 wherein the third lens group comprises at least one aspherical surface, and comprises a meniscus negative lens whose concave surface faces the object side and a lens having a positive refractive power,
 5 arranged in that order from the object side.

4. The small zoom lens according to claim 1,
 wherein the third lens group satisfies the following Condition (1):
 (1) $4.01 < |f_3/f_4| < 60$, where
 10 f_3 : focal length of the third lens group,
 f_4 : focal length of the fourth lens group.

5. The small zoom lens according to claim 1,
 wherein the third lens group satisfies the following Condition (2):
 15 (2) $14 < |f_3/f_w| < 210$, where
 f_3 : focal length of the third lens group,
 f_w : focal length of the entire system at the wide-angle end.

6. The small zoom lens according to claim 1,
 20 wherein the third lens group satisfies the following Condition (3):
 (3) $3 < |f_3/BF_w| < 55$, where
 f_3 : focal length of the third lens group,
 BF_w : back focus at the wide-angle end.

- 25 7. The small zoom lens according to claim 1,
 wherein the third lens group satisfies the following Condition (4):
 (4) $0.85 < |f_{31}/f_{32}| < 1.5$, where
 f_{31} : focal length of the first lens from the object side of the third lens group,
 30 f_{32} : focal length of the second lens from the object side of the

third lens group.

8. The small zoom lens according to claim 1,
wherein the third lens group satisfies the following Conditions (5)

5 and (6):

(5) $|nd31 - nd32| < 0.15$

(6) $|vd31 - vd32| < 3.0$, where

nd31: refractive index of the lens of the third lens group that is
on the object side,

10 nd32: refractive index of the lens of the third lens group that is
on the image side,

vd31: Abbe number of the lens of the third lens group that is on
the object side,

15 vd32: Abbe number of the lens of the third lens group that is on
the image side.

9. The small zoom lens according to claim 1,
wherein the fourth lens group comprises at least one aspherical
surface and a pair of cemented lenses, and comprises a lens having a
20 positive refractive power, a lens having a negative refractive power and a
lens having a positive refractive power, arranged in that order from the
object side.

10. The small zoom lens according to claim 1,
25 wherein when a refractive power of the surface of the fourth lens
group that is closest to the object side is $\phi 41$ and the maximum image
height is RIH, the following Condition (7) is satisfied:

(7) $0.005 < \phi 41/RIH < 0.035$.

30 11. The small zoom lens according to claim 1,

wherein a single lens is disposed closest to the object side in the fourth lens group, and when a refractive power of the surface of the single lens that is on the object side is $\phi 41$ and a refractive power of the surface of the single lens that is on the image side is $\phi 42$, the following

5 Condition (8) is satisfied:

$$(8) \quad 0.04 < (\phi 41 - \phi 42)/RIH < 0.06.$$

12. The small zoom lens according to claim 1,

wherein the fourth lens group comprises a cemented lens
10 constituted by a lens having a positive refractive power and a lens having a negative refractive power, and a single lens having a positive refractive power, arranged in that order from the object side, and when a refractive power of the surface of the cemented lens that is closest to the object side is $\phi 41$ and a refractive power of the surface of the cemented
15 lens that is closest to the image side is $\phi 43$, the following Condition (9) is satisfied:

$$(9) \quad 0.025 < (\phi 41 - \phi 43)/RIH < 0.045.$$

13. A digital camera using the small zoom lens according to claim 1.

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14. A video camera using the small zoom lens according to claim 1.